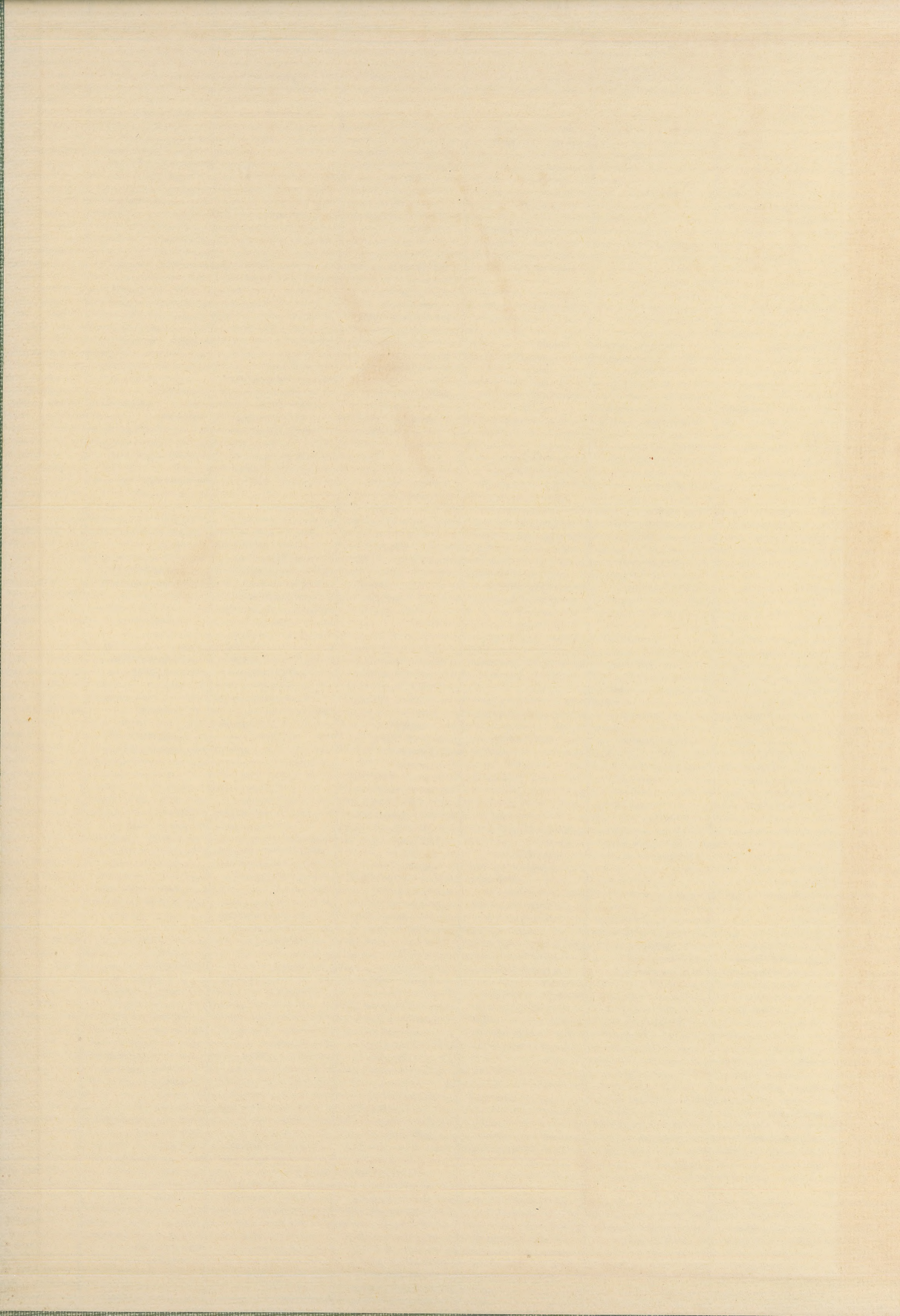


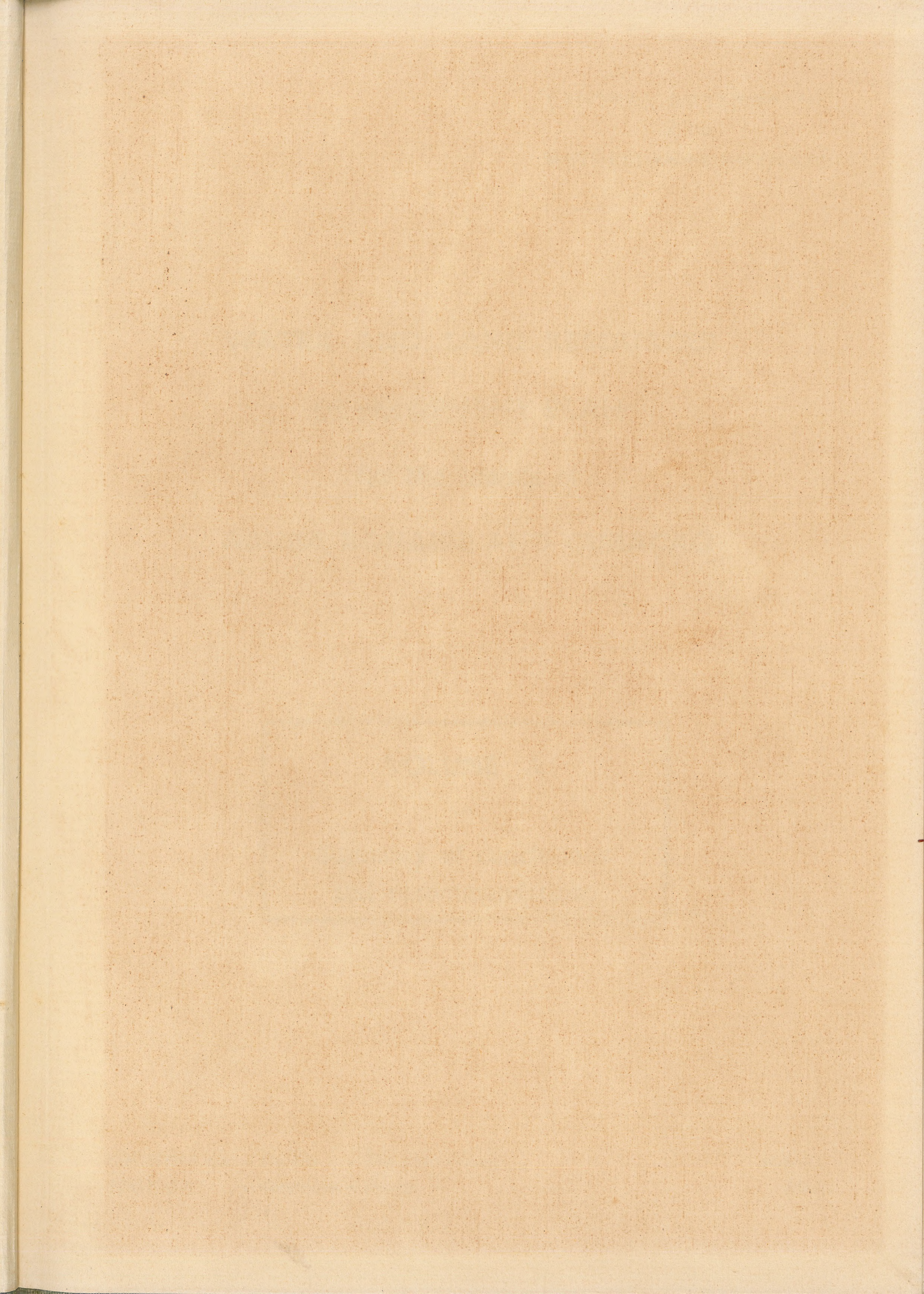
CENTRAL GOVERNMENT  
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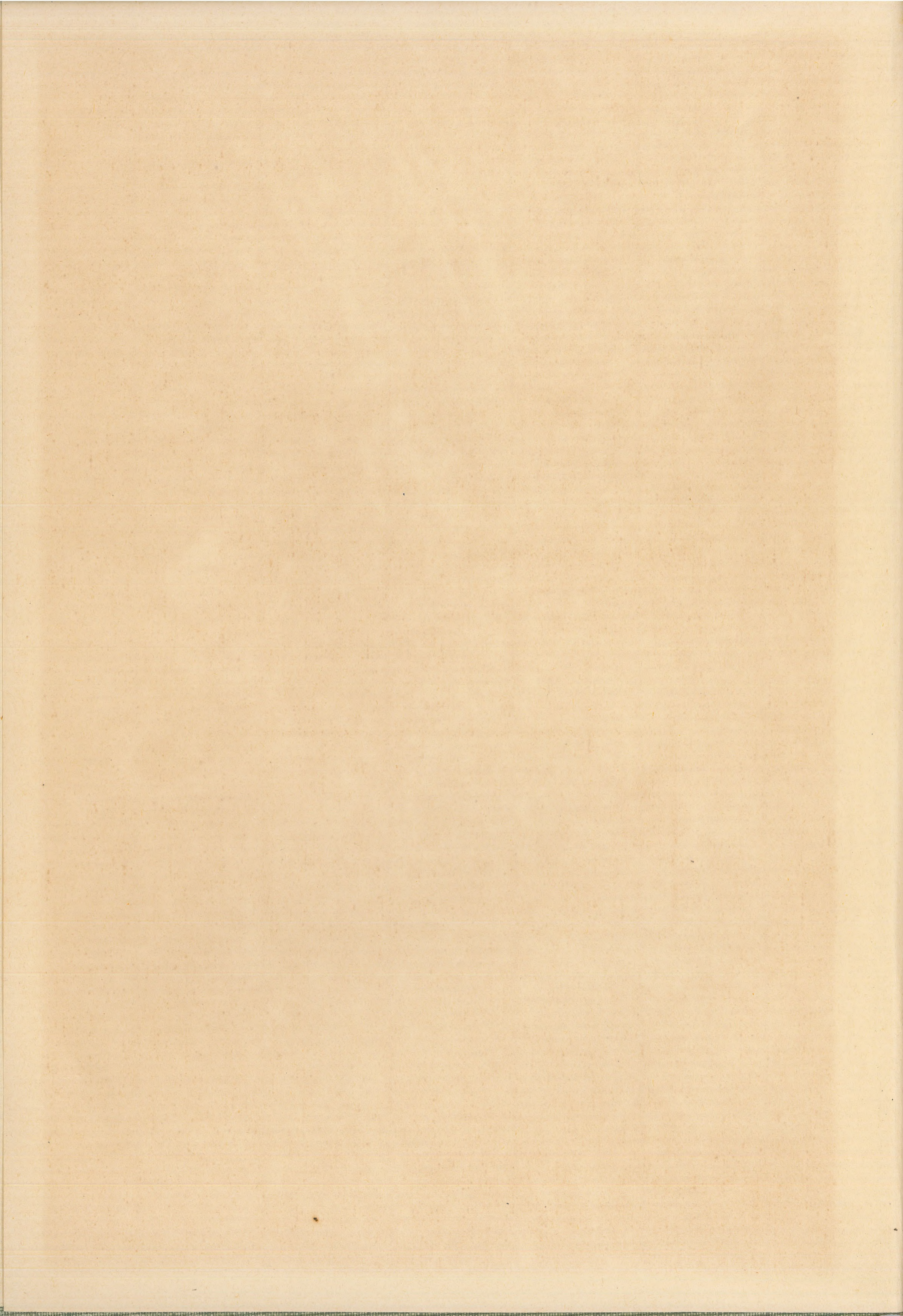
**WATER AND LAND RESOURCES  
DEVELOPMENT PLAN**  
for the islands of  
**ARUBA, BONAIRE AND CURAÇAO**

**VOLUME A**

—  
Summary of conclusions  
and recommendations







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## SUMMARY

### 1 INTRODUCTION

In August 1966 an agreement was signed between the Central Government of the Netherlands Antilles and two firms of consulting Engineers, namely the: N. V. Grondverbetering- en Ontginnings- maatschappij - "Grontmij" and : La Societé Grenobloise d'Etudes et d'Applications Hydrauliques S. A. - "Sogréah". This agreement concerned the preparation of a plan for the agricultural development of the Leeward Islands: Aruba, Bonaire and Curaçao; the term "agriculture" to be taken here in its widest connotation.

For drawing up this plan a study \*) was required, whereby the following parts of the integral plan were studied by a group of experts:

Agricultural Economics	Burer (Proj. Manager) Postma	Grontmij
General Economics	Sousbie (Proj. Manager)	Sogréah
Hydrology	Roederer	Sogréah
Hydrogeology	Bazin Jouhet	Sogréah
Soil-survey	Westerveld van Dijken Schwan Marsman Kinds van der Louw	Grontmij
Hydraulic Engineering	Rozette Puyo	Sogréah
Agriculture	ter Horst Schütz Overes	Grontmij
Animal Husbandry	Mordant	Sogréah
Erosion and Forestry	Beauchène	Sogréah
Recreation	Bijhouwer van Keulen	Grontmij

\*) Fisheries fall outside the Terms of Reference of this study.

Management and Organization	Ballendux	Grontmij
Sociology	van Lier	Grontmij
Marketing	Roy Stella	Sogréah.

The study comprised the period September 1966 up to and including April 1967 for the work on the three islands and the period from May 1967 up to and including April 1968 for drawing up the report in Europe.

During their stay in the Antilles the group has received a most commendable assistance from all Government Bodies concerned, in particular:

Welvaartzorg, Landbouw, Veeteelt en Visserij, Openbare Werken, Sociale en Economische Zaken, Meteorologische Dienst, Kadaster, Justitie, Douane, Veterinaire Dienst, Bevolkingsregister, Water-distributie bedrijf, Touristen Bureau, etc.

In addition to the Authorities also many private persons and enterprises have shown a great interest and actually assisted in making the data elaborated in the report as complete as possible. The group gratefully acknowledges all the assistance received and is obliged for the understanding shown with respect to exceeding the time limit, allotted for completing this voluminous report. We sincerely hope that the present report may render a functional contribution towards the re-development of agriculture and its function in relieving the unemployment and improving the economic situation on the islands Aruba, Bonaire and Curaçao.

This report contains an analysis of the possible development of agriculture on the islands Aruba, Bonaire and Curaçao, based on the survey of the natural resources : land and water and presented in the form of a development plan. A description is given of the various facets which determine the possibilities of agriculture and animal husbandry whilst attention is given to erosion control and reafforestation. The influence is considered of utilizing the islands' resources for the enhancement of their attraction for tourism and recreation.

Seen against the background of the present general economic situation, the possibilities of import substitution for fresh fruits and vegetables and for export of agricultural products are considered not only as a basis for development but also as a necessary effort to improve the equilibrium in the balance of payments. The threat of increasing under- and unemployment was always taken into account when proposing the development projects.

Although the number of projects judged according to various parameters as to their value for the economic development is small, the complexity of the problems is the same for a small as well as for a large country. Therefore, the investigations have included the study of sociological context, juridical measures, organization and management and the proposals include these aspects of

development with its corollaries of import regulation, agricultural research and extension service. The proposals are based on certain policy considerations which are presented in the form of suggestions for the Government to consider as a guide for its development strategy.

## 2 GENERAL CHARACTERISTICS

The three Leeward Islands are situated in lat.  $12^{\circ}$  N. and in  $70^{\circ}$  longitude W., a few miles north of Venezuela and form part of the Caribbean area. Aruba is the smallest island with 19,300 ha (excluding lagoons, reefs etc.), the next in size is Bonaire: 28,100 ha, and the largest island is Curaçao: 44,300 ha. Aruba is the westernmost and Bonaire the easternmost of the three islands.

These islands have a core and basement of basic volcanic rocks of cretaceous age, locally intruded with dioritic batholiths. The inner parts of the islands show outcrops of these rocks, severely attacked by erosion.

Almost complete submergence during upper tertiary times resulted in the formation of coralline limestones and sands, connecting and partly covering the isolated higher parts of the basement rocks. Subsequent erosion, as a result of vertical uplifting, during most of the Quaternary, removed the greater part of the tertiary deposits.

High sea levels, during the interglacial stages of the Pleistocene, gave rise to the accumulation of terraces, consisting mainly of coralline deposits. These limestone terraces border the coasts of the islands. They are dissected by deep erosion valleys and gorges. Later on large parts of the valleys were submerged, forming thus the present inland bays with narrow entrance, e.g. Schottegat and St. Joris Baai on Curaçao and Gotomeer on Bonaire.

Typical for the climate is that the temperature shows practically no variation during the year; neither do the strong north-eastern trade-winds. Of the three islands Aruba is the most windswept. Monthly rainfall, however, varies considerably. In a normal year 64% of the rainfall occurs from October to January inclusive, i.e. within 4 months. Relatively spoken, Curaçao is wettest, Aruba driest, whilst Bonaire is in-between.

Mean annual rainfall as measured at various stations on the islands, is for Aruba from 400 mm to 430 mm, for Bonaire from 385 to 540 mm and for Curaçao from 500 to 600 mm.

It is estimated that on an average only 5% of the rainfall reaches the water table which in principle can be used for irrigation purposes. The small size of the islands and their division into many small catchment areas discharging into the sea are also factors not conducive to the forming of large underground water resources.

Furthermore, this ground water is often brackish. Other water

resources are the many reservoirs made in the course of years by the Government and the population to retain surface run-off water. Due to the uncertainty of the degree of filling and the extreme evaporation losses caused by the continuous high temperatures and strong winds, many of these ponds are not able to bridge over a normal dry period. Moreover, since the local market is small, only a limited use is made of these reservoirs for agriculture.

Another important factor for agriculture is the soil. Large areas of Curaçao and Aruba are badly eroded and hardly usable for agricultural purposes. About 70% of the land on the islands have either no soil cover, or only a very thin one. The best soils, having a depth of over 45 cm, are situated in the downstream parts of the wider valleys, along the streambeds in the smaller valleys, and at the foot of higher lands; they can be found widely scattered over the islands. Moreover part of these soils is saline or saline-alkali and therefore not suitable for crop-growing.

Of the three islands Aruba is the most densely populated with 59,500 inhabitants (1965); then comes Curaçao: 136,300 and the least populated is Bonaire: 6,900 inhabitants. A small part of the population is directly active in agriculture, the majority of which only during the rainy season. The average age of the Antillean farmer is high and the agricultural know-how and agricultural extension are insufficiently developed.

### 3 DEVELOPMENT POSSIBILITIES

Market investigations have shown that about one third of the recent imports of fruits and vegetables can be substituted by local production, saving in that way yearly around \$ 870,000 in foreign currencies. It is to be expected that ABC fruit and vegetables demands in 1975 will be substantially similar to 1965; this demand will be met by the production of an area of 200 to 250 hectares. As far as foreign market possibilities are concerned it can be stated that the association of the Netherlands Antilles with the European Common Market, and the preferential treatment it provides for export of products made in the Antilles, make this area very attractive for the establishment of industries which want to expand their sales to this market of some 180 million people. Attractive propositions for the U.S. and the European Market are aloe (at the moment as resin, but in the future most probably also as aloe-gel) and lime essential oils. As far as meat is concerned the only market that shows interesting aspects is the local market for broilers. For consumption eggs there is also an attractive market.

As already mentioned agriculture is practised by a small number of people, namely about 1,650 divided over the three islands, the majority of which (1,430) is only occupied a few weeks per year. To meet the local demand for fresh fruits and vegetables, irrigation is needed during the whole year, this could be supplied by e.g. purified sewage water.

A larger potentiality of agriculture lies in the cultivation of rain-dependent crops on Class II soils (loamy and sandy soils with a depth of more than 20-30 cm.), of which approximately 8,000 ha. are available on the islands. A condition, however, is that scientific research on crops suitable for the particular climatic circumstances be done.

A crop particularly suitable for the local climate and soils is for example the aloe. Maybe appropriate agricultural research work can select other rain-fed crops suitable for local consumption (e. g. sorghum and millet) and/or for export.

Another possibility is the cultivation of crops only irrigated in the rainy season and shortly after the last rains. Water could be obtained from the existing tankies or new reservoirs. It is obvious that this type of farming which can be practised only a few months per year, cannot bear a high price for the irrigation water. Apart from scientific research, conditions for agricultural development are:

- a. extension work and
- b. organizational and juridical measures in order to regulate the selling of the products.

Besides treated sewage water there is a possibility to obtain fresh water by the construction of hill-ponds and the improvement of existing large surface reservoirs. In total the existing ponds can supply 1.5 million and the new reservoirs 3.1 million cu. m. of water. Together with treated sewage water and ground water the total amount is around 8.8 million cu. m., of which about 8.4 million are considered as real possibilities. Bonaire has the least water resources in proportion to its size and Curaçao has the most. This is mainly due to the availability of sewage water. Not only has Curaçao the most water resources, but the irrigable area is also the largest of the three islands.

An important aspect to be taken into account is the fact that these water resources are widely scattered over the islands and that a point of consideration in the realization of a project is the cost involved in the construction of the irrigation system. On an average the project cost for the distribution of irrigation water is NAfl. 1,40 per cu. m., namely NAfl. 2,73 for Aruba, NAfl. 1,61 for Bonaire and NAfl. 0,90 for Curaçao.

Erosion, although it is not a major problem on the ABC-islands, yet causes a loss of the natural resources: land and water. Methods for erosion control should not only aim at the conservation of water and soil, but also at their utilization. In this connection, the conservation or re-establishment of the natural vegetative cover is most important; this means: the prevention of over-grazing, particularly by goats and all measures for reforestation. To prevent over-grazing by goats the shrub and bush lands which are the natural pastures for goats, may be restored by special measures. These consist mainly of dividing the deteriorated areas into enclosed fields and introducing a rotation system for grazing.

The enclosed fields can either be left by themselves until the natural vegetation has recovered or regeneration can be assisted by the artificial planting of hedges or new fodder bushes along the contour lines.

Reafforestation can be done by planting trees on the denuded areas also along the contour lines. These trees can either be valuable, e.g. bay trees for the production of bay-oil and hard and soft wood for the production of timber, or just without any commercial value, but mostly to beautify the landscape.

#### THE GENERAL ECONOMIC SITUATION

Apart from phosphate the Leeward Islands do not possess any natural resources on which an autonomous economic growth might rely. It is therefore not astonishing that the social and economic evolution of the islands through the last decades was so much dependent on the activities of the oil-refineries on Curaçao and Aruba, furnishing employment for some 21,000 people in 1951, being about 40% of the economically active population and producing some 10% of the world oil production. Per capita National Product and National Income increased considerably, reaching levels superior to what they were then in Europe.

This situation lasted till 1960, though the oil industry had already slowed down its activities due to an expansion of automation combined with a decrease in the quantities handled, resulting in a very sharp drop in the refineries labour requirements (close to 50% of the labour requirement in 1952).

This regression, however, was not reflected in the national accounts because compensating mechanisms were still able to balance the decline as there were: tourism, public works, which growth was due to Dutch and European assistance, and the departure of the foreign labourers who were the first to be sent back to their home countries, retarding the drop in the per capita income of the Antilleans.

Contrary to European nations the high national income caused by two foreign interventions, namely: the oil companies on Aruba and Curaçao, was not the result of a national Antillean effort. The Netherlands Antilles, therefore, did not have any means to control their main (and almost only) source of prosperity. Thus when this source started decreasing its output the Government was faced with two alternatives:

- either develop new dynamic activities able to progressively replace the declining oil industry;
- or, in case this should prove impossible: to accept the fact that the level of life would ineluctably deteriorate.

The 10-year plan of the Curaçao Government is the best proof of the serious effort made to develop new dynamic activities.

#### 4.1 The 10 -year plan for the island of Curaçao

Its first draft made in 1960 can be summarized as follows: Antillean population will grow at a rate of 3.5% per year and non-Antillean population will not vary. Hence, the total population which was 124,500 in 1961 will rise to 169,200 in 1972 of which 56,000 economically active. For these 56,000 people, about 20,000 new jobs had to be furnished. However, in 1965 it turned out that the number of unemployed people had increased from 5,000 in 1960 to 8,500.

A new estimate was then established for the second half of the decade, taking into account a lower rate of growth (2.5% instead of 3.5%) and a higher number of foreigners leaving the islands: both aspects had been observed in the past 5 years. According to this new estimate there will be 48,000 economically active people in 1972. Nevertheless 10,500 will remain unemployed. A remarkable difference between these two calculations is, that after the first 5 years of experience with the 10-year plan, a certain amount of unemployment is accepted to remain. Unfortunately, what is true for Curaçao is also valid for the other islands of the Netherlands Antilles.

As far as the general evolutions from 1960-1965 are concerned, the following can be stated. Though unemployment increased, salaries rose at the same time as fast as retail prices and hence the wage - earners' purchasing power did not decrease by more than 1%. Due to habits acquired in more prosperous days, the per capita consumption only went down by 8% in spite of a drop in per capita income of 15%. As a first result savings dropped from 62 to 18 millions for the whole nation and from 45 to 15 million guilders for households. Moreover, the transfer of capital to foreign countries, though it varies considerably from one year to the other, did not show any tendency to decrease in the long run. All these factors have resulted in a negative balance of payments. Being permanent, this drain of capital is the more alarming since the state budget showed only 2.7 millions for capital maintenance and depreciation, whereas this entry normally requires 8 to 10 million guilders.

#### 4.2 Projections beyond 1965

For the projections beyond 1965 only a few figures are taken into account, viz. : the demographic evolution and the economic activities. Because some data are available until 1970, this year is taken as an intermediate stage, in the period until 1980.

Present demographic forecasts in the Antilles take into account the permanent character of the drop in birth rate (131 births per 1,000 females of 15-44 years in 1965 as compared to 161 in 1962). Hence it is expected that the natural increase of population will be approx. 14.5‰ compared to 22‰ as was calculated in 1965. After 1972 a peak will be expected; by then the today's children constituting a relatively high proportion of the total population will be old enough to procreate.

Another assumption is that emigration is kept at a rate valid for the last few years, which means that an increasing number of Antilleans will leave their country. Under these assumptions, the total population may be around 222,000 in 1971 and 240,000 in 1980.

As far as the economically active population is concerned, it will continue increasing at a rate of  $2\frac{1}{2}\%$  per year until 1977. Making due allowance for emigration, it may be estimated at 70,500 in 1971 and 83,500 in 1980.

Considering the conditions peculiar to the Netherlands Antilles the economic activities can be classified into three large categories. (This classification only partly corresponds to that used by the Ten-Year Plan for Curaçao).

The first category covers the activities which have a positive effect on the Balance of Payments, either by producing export goods or by import substitution. It is obvious that an autonomous and lasting economic equilibrium can be reached only when the value of exports will be able to counterbalance that of the goods purchased abroad. These activities have been called "key activities" since the economic growth of the islands will follow their development. Among such "key activities" are counted oil industry, mining, hotels, agriculture and various other industries whether private enterprises or otherwise (breweries, factories producing furniture or paint etc.) and some State enterprises for a part of their 'production' (airports, telecommunications etc.).

The second category called "dependent activities" are those meant for the local population and facing no foreign competition. They will grow more or less spontaneously and grosso modo at the same rate as population, provided that the "Key activities" grow at a rate allowing per capita income to remain constant. This category includes mainly services, both governmental and private, and administrations.

Finally, the third category "Public works and development Projects" must be considered separately. As far as such activities are made possible by foreign grants-in-aid, they may not be considered as an "autonomous" element affecting economic equilibrium.

Table I gives an estimate of the jobs available on the 31st December 1965 in the various categories, and starting from this distribution what is required to reach economic equilibrium.

Assuming each job contributes 7,000 to 7,500 guilders to the G. N. P. - which is the average value for the Antilles excluded the oil industry - 2,500 to 3,000 jobs would have to be found to compensate the annual deficit of 20,000,000 guilders.

Together with the estimated 12,500 to 13,500 economically active people already working in the "Key activities" in 1965, a total of approximately 16,000 jobs represent the value of these "Key activities". In the same way the other columns have to be read.

For a clear understanding of the figures and the idea behind them, reference can be made to the relevant Chapter in Volume D (pages I-19 and I-20).



Table I.

E CONOMICALLY ACTIVE POPULATION BY TYPE OF ACTIVITY.			
	31st-12-1965	1971	1980
	(estimation)	(conditions of equilibrium)	
<u>"Key activities"</u>	<u>12,500 to 13,500</u>	<u>17,000</u>	<u>18,500</u>
Oil Industry	6,300	3,300	2,500
Hotels	1,300	2,600	7,000
Agriculture/Fisheries	1,000	11,100	9,000
Others	4,000 to 5,000 }		
<u>"Dependent activities"</u>	<u>35,000 to 36,000</u>	<u>38,000 to 39,000</u>	<u>41,500</u>
Sector "Government"	7,000 to 8,000	8,000 to 9,000	-
Others	28,000	30,000	
<u>Construction, Public Works.</u>	2,000 to 3,000	4,000	4,000
Total occupied	51,000	59,000	63,500
Unemployed	13,000	11,500	20,000
Economically active population	64,000	70,500	83,500

Although the figures given in Table I are only estimations, two aspects are obvious:

- the need to find several thousands of new jobs in the "key activities" and
- the continuation of a high unemployment, namely: about 20% of the active population.

As far as the other industrial activities are concerned - the activities which will have to furnish the largest number of jobs - it is clear that due to the small dimensions of the islands, the situation in this sector can change considerably if only a foreign firm or group of firms of some importance decide to settle here.

This is the reason why Antillean Authorities do their best to attract such activities: salt company and radio stations at Bonaire, petro-chemistry at Aruba and Curaçao, but this illustrates also how much the Antilles depend on the exterior.

As was already stated the review given in Table I is based on jobs which are supposed to add each 7,000 to 7,500 guilders to the G. N. P. Knowing that the corresponding added value per job is about 8,700 guilders in the Netherlands and 6,000 in Italy and 3,500 in Japan it

seems rather pretentious to think it possible to find thousands of such highly rewarding jobs with the technical equipment and the human qualification conditions of the Netherlands Antilles. It may therefore be reasonable to conclude that in order to improve the Antillean economy also jobs are necessary adding much less to the Gross National Product than the present average value added per job.

Even then, taking into account the difficulties experienced during the first half of the 10-year plan, it may seriously be anticipated that it will be impossible to find enough jobs, the low-paying ones included, to reach an economic equilibrium and keep the per capita income at its present level.

#### 4.3 Conclusions

The following main conclusions can be drawn from the above given description of the economic situation in the Netherlands Antilles:

- The imperative need to improve the balance of payments makes it necessary to stimulate to the utmost projects aiming at substituting imports by local products and wherever possible, at increasing exports. This can be achieved by utilizing the available resources of labour, land and water.
- The utilization of the present unexploited labour resource in order to strengthen the national economy seems to be essential even in those cases where the added value per job is much less than the present average.
- Within the limits of economic forecasting there seems to be no hope of finding jobs for all the economically active people and because the pressure of unemployment will undoubtedly have its effect on the wages, it seems unavoidable - how deplorable in itself this might be - to take into account a lowering of wages.
- Neither the State, nor local private capital will be in a position to cope with the need of investment which will arise. The Netherlands Antilles will thus remain dependent on foreign countries from which they should receive financial aid.

#### 5 POLICY CONSIDERATIONS

From these economic conclusions a number of policy considerations can be derived which may be useful as points of orientation. First of all it is obvious that all the natural resources as labour, land and water, have to be utilized also in agriculture to save or to obtain foreign currency through import substitution or export.

To achieve optimum results, scientific agricultural research is essential, in particular for the rain-dependent agriculture, because this type of farming represents the largest potentiality in agricultural development. Moreover, substantial development seems possible if profitable crops are found.

If this pre-requisite is properly met, then the farmers have to be assisted by a proper extension service and strengthened by credit facilities, a system of import regulations and selling-organizations: briefly, by adequate organizational and legal measures in order to give this group of the population a fair chance of success.

Also a thorough revision of the legislature on land and water now in force seems indispensable to secure an efficient use of the scarce natural resources: land and water.

In guiding the overall agricultural development, Government may also consider to carry out long-term projects which eventually have a productive effect, by way of justified relief work, since organizing relief work in the near future seems anyhow unavoidable. Financing of a number of long-term projects by means of foreign aid and sinking funds will be necessary and justifiable, provided they lead to a permanent increase of the national income. Government subsidies and guarantees in the initial stage of some projects seem indispensable.

For guiding the agricultural development and preparing the necessary steps in time, the establishment of a proper organization may be considered, set up in the shape of a foundation, having the great advantage that profits made on the remunerative projects are to be re-invested in projects with a marginal character, making in this way the optimum contribution to a rapid development of the agricultural sector as a whole.

## 5 THE DEVELOPMENT PLAN

After having described the general economic situation and its effect on the national income and employment, and also having discussed the delicate policy considerations involved, it has to be stated that a number of agricultural projects can be realized which will have a favourable impact on the socio-economic situation of the ABC-islands.

However, each project has its typical characteristics that make it difficult to establish a priority scheme. One project e.g. may be labour-intensive and by that fact will have a favourable effect on labour employment, a second project may have a high added value, a third may have a good employment effect and a reasonable added value, but need some years of research, a fourth is necessary to protect the islands' natural resources, another is a *conditio sine qua non* for development, and so on, and so forth. Besides that, a number of projects have more than one aspect or are interrelated. Out of the many criteria by which a project can be appraised the most relevant ones may be chosen, e.g.:

1. The necessity to start agricultural development.
2. Economic quantitative criteria (added value, jobs created, capital intensity, investment per man-year, cash flow evolution) and some qualitative or descriptive criteria as: markets, and human factors, for example: the dependence on private enterprise, obstacles due to landownership, etc.

### 3. The necessity to protect the islands' natural resources.

Based on these criteria a number of activities and projects, forming together the development plan, have been selected. They can be described as follows:

#### 5.1 Foundation

One of the first steps to be taken in implementing the development program is the establishment of a "Foundation of Rehabilitation and Development of Agriculture on the Leeward Islands", and the appointment of a Managing Director who will be in charge of all the necessary steps to be taken. Apart from undertaking new ventures, this agency should also encourage and give guidance to existing activities in the field of agriculture, animal husbandry, erosion control and forestry. This foundation should be run, wherever possible, on strict business lines, which implies the making of profits, to be re-invested in agriculture. When the setting up of the foundation has made sufficient progress, a Board of Directors will have to be formed consisting of officials and non-officials.

The Minister of Social and Economic Affairs or the Vice-Prime Minister may be its Chairman and each Island Government may be represented by one member.

As technical members the Board may comprise:

the Managing Director,  
 the Representative of Shell,  
 the Director of the Central Bureau for Economic Development,  
 a banker as an expert on financial matters,  
 a leading industrialist,  
 a representative of commerce,  
 a non-official with a profound knowledge and experience of the problems attached to agricultural development on the ABC-islands, such as for example the Director of the Research Station to be established.

A Board of Directors composed on these lines seems sufficiently small (11 members) to be wieldy and at the same time diversified enough to be able to cope with the multiple problems it will be confronted with.

Since the Foundation should be managed as efficiently and economically as possible, it is recommended that it should expand only gradually, and for the time being comprise only:

- Program management (a Managing Director, an understudy and some clerical assistance).
- Extension service (one official and a small staff of field-workers).
- Service of Erosion Control, Reafforestation and Landscaping (one head and 2 assistants).
- Service of Animal Husbandry (one head and a small clerical staff).

## 5.2 Legislative support

One of the first activities of the Foundation should be to further the enactment of some new laws and the amendment of the existing legislation. Actual drafting work can be done by the very capable local lawyers, with the technical assistance of an international expert with sufficient knowledge of Dutch Law and fully acquainted with the theory and practice of water legislation, land tenure problems and cooperatives in developing countries.

Most urgent is the drafting and enacting of:

- appropriate water legislation;
- a new law concerning cooperatives;
- basic legislation indispensable for comprehensive town- and country planning;
- a law limiting private property rights in land;
- legislation concerning import regulation on agricultural produce;
- an amendment of the expropriation law in force.

## 5.3. Agricultural Research and - Centres

It is proposed to establish the Research Station (referred to above) at Klein Kwartier (Curaçao) on Government property, and to approach in this respect an institute well equipped and with extensive experience. Together with the agricultural research station, agricultural centres have to be started on the three islands, first to enlarge extension activities and later on also to offer the Research Station the opportunity to carry out their experiments on a larger scale. The agricultural centres are planned at the Government property Santa Cruz on Aruba, Ambwana on Bonaire and at Klein Santa Marta on Curaçao; the last mentioned centre also has to be provided with facilities for a central tree nursery for reforestation purposes.

## 5.4 The projects

As already mentioned in the analysis of the economical situation it is of paramount importance that the projects be aimed at the restoration of the balance of payments by replacing import or increasing export.

Apart from these, also a number of projects are proposed which are necessary to restore the islands' natural resources. All the projects will be described very succinctly in order to give the interested reader a rough idea; according to their main characteristics they are divided in 4 groups.

The first group comprises projects which can be considered economically feasible. They will provide full-time employment at normal rates of remuneration and hence justify the adoption of farming as a profession.

The projects of the second group show a seasonal requirement in labour because they are rain-dependent. Apart from that, their implementation depends mainly on private activity, due to the present land

tenure ship, which does not facilitate Government intervention. Because of their particularly good capital intensity ratio their realization is justified in spite of the difficulties involved in mobilising private enterprise and the uncertainties hanging over their long-term market prospects.

The third group might be called "Reserved for the future". Generally speaking, any assessments as to the feasibility of their possibilities will be subject to further experimentation. At the moment it has not been possible to define these possibilities with the same precision in all cases, reason why this group represents in fact, more a reserve of potential for the future, than a set of immediately feasible projects.

The fourth group consists of the "conservation operations". Projects of this group have as an objective the protection or restoration of the islands' natural heritage. The added value resulting from these schemes is either low (improvement of goat and sheep-farming) or only measurable on a very long-term basis e.g. timber production. The justification of these projects therefore lies essentially in their ability to provide useful work for the unemployed. As a side effect they may also help to improve the country side.

#### 5.4.1 Projects of Group 1

##### A. The Malpais Project

A horticultural project located at Malpais and receiving its necessary irrigation during the whole year from the Klein Hofje - sewage water purification plant. At Malpais eventually 55 family farms (of 1 ha.) united in a co-operative will be established, and each farmer will be trained during 3 years at the training-school of the project; after the training-period the farmers will be guided by the extension service. The produce will be sold through a commercial organization equipped with storage and cooling facilities in order to prevent fluctuating supplies and stabilizing in this way the market-prices.

##### B. The Groot St. Joris Project

Ten to 15 km. east of Willemstad, around the St. Jorisbaai, and located at the plantation Groot St. Joris, citrus growing is planned viz. ; 95 ha. oranges for the homemarket and 95 ha. lime trees for the export of essential oils. This project will be continuously irrigated with purified sewage water from the Klein Kwartier-plant and is expected to be ready approximately 6 to 8 years from now. About the same period is estimated to be necessary to obtain the suitable planting material. Here, again, agricultural research is indispensable. Although during the initial period of, say, 10 years the project needs to be centrally organized, eventually a transition to a co-operative structure of individual growers is to be foreseen.

### C. The Poultry Project

Aiming at the substitution of imported chicken meat and eggs on Aruba and Curaçao this project finally provides for 23 farms (15 on Curaçao and 8 on Aruba) to meet the requirements of broilers, and 12 farms (7 on Curaçao and 5 on Aruba) with 2,500 laying-hens each, in order to replace the necessary 6 million eggs imported annually. Also 12 farms (all located on Curaçao) are needed to furnish day-old chicks for laying-purposes and for the broiler farms.

A dry slaughterhouse on both islands will be essentially equipped with pre-cooling, cooling and packing facilities and an ice producing plant. Further on there should be a factory to prepare the needed chicken mashes. In view of the present price structure it is certain that success can only be reached by overall measures which for many reasons need to be carefully co-ordinated at the national level. These measures will include initial subsidies, training of future farmers and Government support to obtain the full market for local production on which the development is based.

Although a rough estimate has shown the profitability of this specific activity a more detailed survey is advisable and indispensable before the poultry business can be realized.

#### 5.4.2 Projects of Group 2

##### A. The Aloe-rehabilitation

For Aruba and Bonaire an area of 1,000 ha. on each island is proposed to be rehabilitated. This project is directed to enlarge the export quantity of aloe resin. The rehabilitation program, if executed by one central organization for both islands, can result in a stable attractive extra income for the part-time farmers involved. The central organization not only has to handle problems connected with a proper cultivation and harvest methods, but also has to deal with processing and qualified grading to secure quality, and last but not least has to study continuously the possibilities offered on foreign markets. This might mean that steps have to be taken in time to start research on producing aloe-gel for the cosmetic industry.

##### B. The Cultivation of Rain-dependent Cereals

Although rain-dependent farming can be improved by more intensive extension work on cultivation methods, the use of better seeds and planting material, a more effective control of plagues and diseases, of better pig-goat- and even cattle-breeding, special reference should be made here to: millet-growing. Out of the total of appr. 17,000 tons of cereals imported at present, about 10,500 tons could be produced locally on 3,500 ha. (700 ha. on Aruba, 900 ha. on Bonaire and 1,900 ha. on Curaçao). This will yield an extra income for many part-time farmers. However, it is assumed that the most suitable variety can only be selected after well-guided research, for which it is estimated that approximately 3 years of work will be necessary.

### 5.4.3 Projects of Group 3

There are also a number of possibilities based on an additional supply of water from reserves to bridge undesirable long dry periods in the rainy season, or in case there is sufficient rain: to prolong the rainy season as much as possible. It is obvious that under the rather opposing conditions of a limited farming during 4 or 5 months only, and on the other hand an - in comparison - expensive irrigation system, the execution is for the time being not advisable from a purely economic point of view.

Only if and when favourable results are reached by the research station as regards profitable crops with a short growing period or drought-resistant perennial ones, or only if a very lenient yard stick is applied may these projects warrant execution. They are for example: additional irrigated agriculture with or without animal husbandry, in particular intensive stock-farming of pigs on small family farms, which have some attractive aspects. Also the growing of lime or other fruit trees with a limited amount of water might be profitable; maybe the cultivation of bay trees will also appear to be justified. However, for the time being we cannot but indicate the possibilities, without recommending them.

### 5.4.4. Projects of Group 4

Apart from the projects which will have a direct favourable effect on the national income, there are a number of activities, non-paying in themselves, but still necessary, as for instance: erosion control and reafforestation to protect the islands' natural resources, or goat-control to prevent further denudation. Though non-paying, these projects have the advantage of creating a large volume of work for 15 to 20 years, to be done in a period complementary to the season needed for rain-dependent agriculture.

#### A. Projects for goats and sheep

These projects have as their main objective: to bring the number of animals in harmony with the grazing capacity of the various pastures. This is particularly necessary for the goats and their uncontrolled grazing. Under the best present conditions, the shrubland provides subsistence for five goats per hectare, however, this ratio may be 1 goat per 10 hectares in areas severely overgrazed. In order to be able to start with an effective method of rotation-grazing, reserve areas will be required to accommodate temporarily the flocks of goats from the area to be recuperated. Also reserves will be necessary during exceptionally dry years. For this purpose a number of more or less derelict estates could be acquired. In the plantations to be recuperated, new enclosures with closely spaced fodder hedges will be established. Once they are ready, they can serve as buffer pastures and nuclei around which the improvement of natural pasture can be started, together with the beginning of a system of rotation of the local flocks of goats.

However, whether the number of goats is made proportional to the



capacity of land by reducing the number of goats or, whether by improving the available pasture land, is a political rather than a technical matter. For the development of the ABC-islands it is essential that the goat-problem be solved by basing the rational use of available improved pastures on a strictly controlled rotation of grazing.

#### B. Erosion Control and Reafforestation

In general, accelerated erosion is the result of human interference. Eroded areas are found where deforestation, overgrazing and earth-moving have induced and accelerated the erosion. The most arid and perhaps the most wind-swept of the three islands, i. e. Aruba, is most eroded, combining conditions most conducive to erosion as, for instance : a marked aridity, erodible soils, a high population density and many small farms cultivating rain-dependent crops and as a result of which the soil lies bare approximately 5 months per year.

Bonaire is in a privileged position owing to its low population density and Curaçao is considered to be in-between Aruba and Bonaire as far as eroded areas are concerned. Methods for erosion control should not only aim at the conservation of soil and water, but also at their utilization.

The measures recommended to be taken are:

- the restoration of natural pastures and grazing lands combined with control of the grazing-intensity;
- measures preventing run-off and increasing the infiltration of water, as well as preventing wind-erosion, in particular in the areas of rain-dependent farming;
- repair of faha's (small dams of loose stones to detain run-off water) and the stimulation of their construction in the valleys and on the lower slopes of the hills;
- improvement of existing shrub land by replacing unwanted shrub species by more valuable forage. In suitable areas forage shrubs and trees are planted, forming in this way fodder hedges to enlarge the grazing-capacity of the area;
- improvement of existing forest land by citrus (lime) forests at favourable sites and in the remaining areas forests of timber- or bay trees producing aromatic oils;
- a central nursery for the three islands located at Klein Santa Marta.

#### 5.4.5 Projects related to Tourism and Recreation

These projects are based on the principle that the natural beauty of Aruba, Bonaire and Curaçao is reflected in its semi-arid appearance. Moreover, the dry climate and the scarcity of sweet water exclude every idea of transforming the islands or parts of them in such a way that they can compete with other more lush and moist tropical islands.

Therefore, tourism being of paramount importance to the islands' economy, the activities have mainly to be directed towards making the islands' beauty attainable for the tourists. This can be done by constructing scenic roads to picturesque points, places of historical interest, beaches, bays, etc., and also by establishing refreshment places along these roads. Furtheron, the improvements or construction of public beaches, seaports, marina's, holiday resorts and nature reserves to enlarge the possibilities of tourists and local recreation.

All the provisions for tourism and recreation should be based on a comprehensive plan in which the various aspects of hotel accommodation, road improvement and others are interrelated and co-ordinated. This plan can serve as a focus for discussions concerning development of tourism or can be used to direct legislative measures. Drafts of such a plan are included in this report.

#### 5.5 The effect on Employment and Economic Situation

From the foregoing it is clear that there are projects which from an economic point of view are justified to be realized (Malpais, Groot St. Joris and the Poultry-project); there are other projects of which this is not so sure, but where there exist strong arguments for their realization from a sociological standpoint (the cultivation of aloe and cereals) or which are nothing but a necessity to start development or to restore and maintain the islands' natural resources, e.g. the Research Station and the Agricultural Centers, as well as the projects relating to goats & sheep and erosion control.

It can also be understood that for economically sound projects money can be borrowed, true, on a soft-loan basis only, and that the more "difficult" projects will rather have to be considered for financing by sinking funds. An important aspect in the economic analysis is the remuneration of labour. In the calculations two levels of labour wages are considered, viz. a "normal income of labour", that is an income level which may seem acceptable under the present conditions and a "low income of labour" which is found by multiplying the "normal" level by 0.85, assuming that workers will accept these wages when economic conditions deteriorate.

Furthermore it has been assumed that the projects of Groups 1, 2 and 4 will be realized in due time and can be considered as one set of activities. In this way the profits made on the better projects - however small these may be - can be re-invested in the weaker projects and the labour requirements can complement each other.

The plan, as it is proposed, requires up to 2,000 man-years during some 10 years. At Curaçao the number of employed starts decreasing in the 15th year, whereas this number does not vary on the other two islands up to the 20th year. In all three cases, the problem of seasonal unemployment will take its full importance after the 20th year unless new activities have replaced the old ones by then.

If these projects are developed together annual capital requirements after reaching a peak of NAfl. 6.4 or 5.4 million (calculated on the basis of normal and low income level, respectively) will gradually decrease until a positive balance is reached in the 21st year. Therefore, a financial aid program should be envisaged over the first 20 years. The cash requirements needed over this whole period will amount to around NAfl. 100 million (or NAfl, 83 million with low labour income). The Antillean Nation would then be left the benefit of a regularly positive balance.

As a whole this financial program would give the following results:

- furnish during 20 years a volume of work equivalent to some 34,000 man-years,
- develop on the islands units of production which later will have a yearly value added of around NAfl. 4.5 million through the creation of an equivalent of 1,000 permanent jobs,
- solve the problem of uncontrolled goat grazing and restore the natural wealth of the islands.









